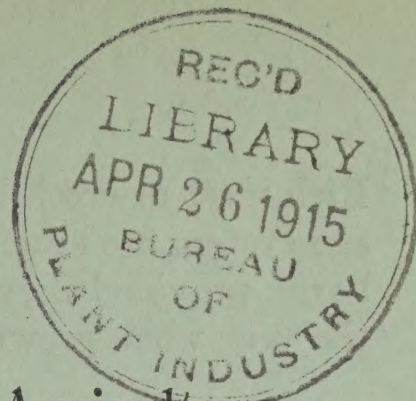


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# United States Department of Agriculture,

## BUREAU OF PLANT INDUSTRY,

Forage-Crop Investigations,

WASHINGTON, D. C.

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### ALFALFA (*Medicago sativa*).

Instructions adapted to Michigan, Wisconsin, and Minnesota.

#### DESCRIPTION.

Alfalfa is a deep-rooted, hardy, perennial forage plant, belonging to the family which includes beans, peas, and clover. It occupies the same place in western agriculture that clover fills in the eastern part of the United States. In chemical composition it resembles the clovers, peas, and allied legumes in having a high protein content, but it slightly outranks any of these that are now under cultivation in both total and digestible protein and yields a greater tonnage per season. Since it is a perennial, it will last a number of years unless crowded out by weeds or otherwise destroyed.

#### SOIL REQUIREMENTS.

A deep, fertile, well-drained, nonacid soil, reasonably free from weeds, is required. The crop can be made to grow on soils of almost any texture, but the proportion of failures is apt to be greater on deep, porous sands or sands underlain by gravel. It is practically useless to sow alfalfa on thin soils where the bedrock approaches the surface, on land underlain with hardpan, or in locations where the subsoil is so compact that the roots can not penetrate it to considerable depths. It is also equally useless to attempt to grow alfalfa on land where the water table comes near the surface. For the purpose of ascertaining the character of the soil and subsoil and also the depth to the water table, frequent borings should be made with a soil auger. In determining the adaptability of a tract of land to alfalfa, this instrument in most cases will be of greater assistance than a chemical analysis of the soil.

Not only should the land have good underdrainage, but the surface should have sufficient slope to carry off the surplus water readily. In fields that are too level, or in pockets, the formation of ice is fatal to alfalfa. Even on considerable slopes ice may form on the surface, but this is a danger that can not be avoided and is least on the slopes.



Rich river or creek bottom lands that have a well-established drainage system are admirably suited to the crop. Overflows may do no harm, provided they are not of long duration and come at a time of the year when growth is practically dormant.

#### PRECEDING CROP.

Alfalfa may follow almost any farm crop if sufficient time is taken to prepare the seed bed and rid the soil of weeds. Cultivated crops, such as potatoes, corn, or beans, are admirably suited for this purpose. Alfalfa may also follow small-grain crops, provided the land has previously been treated in such a way as to destroy the weeds. Seeding on sod land is not recommended unless sufficient time can be given to its preparation to decompose the sod and eradicate the weeds before seeding time. More satisfactory results are secured when such land is devoted to some cultivated crop for a year or two before seeding the alfalfa.

#### PREPARATION OF THE LAND.

Many of the failures to secure a good stand may be traced directly to the improper condition of the seed bed. The aims to be sought in preparing land for alfalfa are a firm, fine seed bed that is free from weeds. Four to six weeks should intervene between the time of plowing and that of seeding, and meantime the land should undergo frequent cultivations. Where it is practicable, fall plowing is recommended. In the spring the land should be disked thoroughly and harrowed at intervals of a week to 10 days until the seed is sown. In some cases it is possible to get a crop of early potatoes off in sufficient time for seeding alfalfa the same season. If the potato ground has been well cultivated, it will require little further preparation for the alfalfa.

#### LIMING.

The use of lime is not essential on all soils in this region, but it is sometimes difficult to tell whether an application of lime is needed before seeding. If, however, there is any doubt concerning this point, the land should be limed. The lime may be applied with a manure spreader, a fertilizer distributor, a lime distributor, or by hand. Any method which spreads the lime uniformly and at low cost is satisfactory. It should be applied at least two or three weeks before seeding, in order that it may become thoroughly incorporated with the soil. At least a ton of burned lime is generally required, and larger applications are often necessary on the heavier soils. If ground limestone or ground oyster shell is used, the quantity should be double that of the burned lime.

Experiments have shown very little difference in the final results obtained from the different forms of lime. Burned lime will give



quicker results, but the ground limestone and ground oyster shell will finally give the same benefit. The essential element in lime in any form is the calcium oxid, and it is recommended that the farmer use whichever form of lime is cheapest, based upon the percentage of this element present. Where the consumer pays the freight, it should be remembered that he will not only have to pay such charges on practically twice as much of the ground limestone as of the burned lime, but will also be to the additional expense of hauling and spreading 2 tons of the former to 1 of the latter in order to obtain the same results.

#### FERTILIZATION.

Well-rotted barnyard manure which is comparatively free from weeds is the most satisfactory fertilizer. It should be spread on the land before plowing, in order that it may become thoroughly incorporated with the soil. Good results also follow from heavy applications to the preceding crop. Where this is not available, the judicious use of commercial fertilizers will in many cases increase the chances of success in the seeding of alfalfa. An application of 75 to 100 pounds of potash, 350 to 500 pounds of acid phosphate, and 50 to 75 pounds of nitrate of soda per acre is suggested.

#### INOCULATION.

Nitrogen-fixing bacteria should be provided unless the soil is known to be naturally supplied with these germs. This may best be accomplished by scattering over the area to be seeded soil from a field upon which the crop has previously been successfully grown. The soil should be broadcasted at the rate of from 250 to 500 pounds per acre and harrowed in immediately. The spreading should take place on a cloudy day or in the evening, as the sun's rays are destructive to the germs. Soil from the roots of sweet-clover plants also will inoculate alfalfa. Care should be taken to avoid introducing noxious weeds and fungous diseases. The practice of sowing a small amount of alfalfa with the regular seeding of clover each year for a few years before it is intended to devote the land to alfalfa has in some cases apparently introduced sufficient bacteria for inoculating the succeeding crop of alfalfa. Another method which may be used is that of inoculating the seed with an artificial culture, a limited quantity of which can be procured from the United States Department of Agriculture free of charge. Full instructions for use accompany each bottle of culture. The combined use of the soil and the artificial culture is recommended where both can be readily obtained.

#### SEEDING.

Alfalfa seed should be sown at the rate of 20 to 30 pounds to the acre. It may be drilled or sown broadcast and covered with a smoothing harrow or weeder. A more even stand is secured if the seed be



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#### SEEDING.

The seed should be sown at a rate of 25 to 30 pounds per acre, the heavier seeding being preferable, as it makes hay of a finer quality and helps to keep down the weeds. It may be drilled or sown broadcast with a wheelbarrow seeder and covered lightly with a smoothing harrow or weeder, care being taken to avoid covering deeper than 1 to 1½ inches. As a rule, a higher percentage of germination is secured from drilling; and, such being the case, the quantity of seed used per acre may be slightly decreased. A much more even stand can usually be secured by dividing the seed and sowing one-half each way of the field. The most successful stands of alfalfa are secured from seeding late in June or as soon thereafter as moisture conditions are favorable. It is seldom safe to seed much later than August 15, as the plants will not have sufficient time to become thoroughly established before winter sets in. Successful stands are occasionally secured from early spring seeding, although they are not generally recommended. A nurse crop should not be used unless the seed is sown in the spring, when 1½ bushels of oats or beardless barley, preferably the latter, may be used to help keep down the weeds. This should be cut for hay; otherwise the growth of the alfalfa may be seriously checked. Successful stands have also been secured from sowing with early canning peas. In some cases, the seeding of alfalfa in standing corn in the latter part of July has given successful results, but this method can be expected to succeed only when conditions are highly favorable.



## TREATMENT OF THE STAND.

In spring seedings, unless the weeds threaten to choke out the young plants, they should not be clipped until they are 12 to 15 inches high and beginning to bloom. The cutter bar of the mower should be set high, as the alfalfa is likely to be injured if cut low. If the first cutting is light it may be left on the land as a mulch. If heavy enough to smother the alfalfa plants it should be removed. A fall seeding should not be mowed until the following spring, when it can be cut for hay as the plants start to bloom. When the plants turn yellow the crop should be cut immediately and removed from the field. If the stand becomes thin or patchy the field should be plowed and reseeded. Attempts at patching up poor stands have generally proved futile. In cases where the soil has become compact from pasturing or where weeds are so numerous as to threaten considerable injury to the crop, cultivation in the spring or immediately after cutting, with a weeder in the sandy soils or with a spike-tooth harrow or an "alfalfa harrow" in the heavier soils, may be advisable. No implements which will seriously injure the crowns and permit diseases to enter should be used. A top-dressing of well-rotted, weed-free stable manure applied in the late fall or winter will not only furnish some protection but will also in most cases increase the yields the following season. If the stable manure is not available or if there is any doubt about its being comparatively free from weeds, a top-dressing of 300 or 500 pounds of acid phosphate per acre, with a small amount of potash, may prove beneficial.

Alfalfa makes good pasture for nearly all kinds of farm animals, but under no circumstances should it be pastured before it has become thoroughly established or when the ground is wet or frozen. It should not be pastured closely at any time, for the grazing down of the crowns will often result in destruction. Owing to the difficulty of procuring a good stand in the East it is very doubtful whether a farmer should take the chance of injuring a well-established stand by pasturing it at all.

## SOME COMMERCIAL VARIETIES OF ALFALFA.

*Common alfalfa.*—Under the term "common alfalfa" is included the greater part of the alfalfa grown in the United States, the seed from the various sources frequently being designated by the State in which it was produced. Where alfalfa has been grown under a certain set of conditions for a considerable time there is a tendency, through elimination, to produce a different type presumably better adapted to the conditions under which it was developed. Thus, for instance, seed from fields that have been grown for several seed



generations in Montana and the Dakotas may be somewhat more hardy than that grown farther south. Likewise, seed grown under semiarid conditions without irrigation may be superior for dry-land farming. In sections where winterkilling is not a factor the ordinary types are recommended in preference to the so-called hardy alfalfas, as they generally produce somewhat heavier yields.

*Turkestan.*—Turkestan alfalfa was introduced into the United States from Turkestan in 1898, and during recent years practically all the seed imported into this country has been from this source. This variety, although quite variable, resembles common alfalfa in general characteristics, but, as a rule, it does not produce quite as heavy yields. Selected strains have proved somewhat superior to the ordinary alfalfa both from the standpoint of hardiness and that of drought resistance. This variety as a whole is decidedly inferior to the alfalfa commonly grown in this country, especially in the humid sections.

*Grimm.*—Grimm alfalfa was introduced into this country in 1857 from Baden, Germany, by Wendelin Grimm, of Carver County, Minn. Careful investigations indicate that it owes its superior hardiness to the fact that it is the result of a natural cross between the common variety and the yellow-flowered alfalfa (*Medicago falcata*), and by virtue of its being exposed to numerous severe winters the weaker plants were eliminated, leaving only the hardy ones to perpetuate the strain. Grimm alfalfa does not differ materially in appearance from the ordinary strain, so that the casual observer has difficulty in distinguishing one from the other. While a large percentage of its flowers are of the same color as those of common alfalfa, there are some that represent many shades of violet, yellow, and other hues. The taproots show a tendency to branch, and the crowns are inclined to be low set and spreading, characteristics which undoubtedly are of great importance in rendering the variety resistant to drought. Grimm alfalfa is one of the hardiest, if not the most hardy, of our commercial strains. It is recommended for sections where the winters are especially severe and where little protection is given by snow. In sections where winterkilling is not an important consideration it is not thought to be materially superior to common alfalfa.

*Sand lucern.*—Sand lucern, like Grimm alfalfa, is the result of a natural cross between the common and yellow-flowered varieties. The commercial strains show considerable variation in hardiness and yield. In general, the sand lucern has shown somewhat greater resistance to cold than the common strains, and it is therefore better adapted to the Northern States where winterkilling is a factor. The yields, while satisfactory, are not quite equal to those of the ordinary types. Its chief drawback is its tendency to lodge.



*Canadian variegated*.—The type of alfalfa known as Canadian variegated is also the result of a natural cross between the common and yellow-flowered types. According to the best evidence available, its history in Canada is similar to that of Grimm in Minnesota. Under severe winter conditions it seems to be slightly hardier than the ordinary sorts and may be used to good advantage where the winters are severe. In point of yield it is not quite equal to the common alfalfa.

*Baltic*.—The Baltic alfalfa has been so named from the fact that the seed was originally procured from Baltic or Hartford, S. Dak. It was grown for 10 years near Renner, S. Dak., with marked success. Careful tests indicate that this strain is practically identical with Grimm, and the discussion concerning the adaptations of the Grimm apply equally well to the Baltic alfalfa.

For further details, see Farmers' Bulletin 339, entitled "Alfalfa."

H. L. WESTOVER,

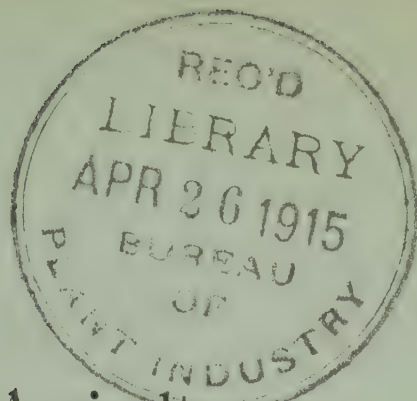
*Assistant in Agronomy.*

JANUARY 22, 1915.









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#### DESCRIPTION.

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#### SOIL REQUIREMENTS.

A deep, fertile, well-drained, nonacid soil, reasonably free from weeds, is required. The crop can be made to grow on soils of almost any texture, but the proportion of failures is apt to be greater on deep, porous sands or sands underlain by gravel. It is practically useless to sow alfalfa on thin soils where the bedrock approaches the surface, on land underlain with hardpan, or in locations where the subsoil is so compact that the roots can not penetrate it to considerable depths. It is also equally useless to attempt to grow alfalfa on land where the water table comes near the surface. For the purpose of ascertaining the character of the soil and subsoil and also the depth to the water table, frequent borings should be made with a soil auger. In determining the adaptability of a tract of land to alfalfa, this instrument in most cases will be of greater assistance than a chemical analysis of the soil.

Not only should the land have good underdrainage, but the surface should have sufficient slope to carry off the surplus water readily. In fields that are too level, or in pockets, the formation of ice is fatal to alfalfa. Even on considerable slopes ice may form on the surface, but this is a danger that can not be avoided and is least on the slopes.



Rich river or creek bottom lands that have a well-established drainage system are admirably suited to the crop. Overflows may do no harm, provided they are not of long duration and come at a time of the year when growth is practically dormant.

#### PRECEDING CROP.

Alfalfa may follow almost any farm crop if sufficient time is taken to prepare the seed bed and rid the soil of weeds. Cultivated crops, such as potatoes, corn, or beans, are admirably suited for this purpose. Alfalfa may also follow small-grain crops, provided the land has previously been treated in such a way as to destroy the weeds. Seeding on sod land is not recommended unless sufficient time can be given to its preparation to decompose the sod and eradicate the weeds before seeding time. More satisfactory results are secured when such land is devoted to some cultivated crop for a year or two before seeding the alfalfa.

#### PREPARATION OF THE LAND.

Many of the failures to secure a good stand may be traced directly to the improper condition of the seed bed. The aims to be sought in preparing land for alfalfa are a firm, fine seed bed that is free from weeds. Four to six weeks should intervene between the time of plowing and that of seeding, and meantime the land should undergo frequent cultivations. Where it is practicable, fall plowing is recommended. In the spring the land should be disked thoroughly and harrowed at intervals of a week to 10 days until the seed is sown. In some cases it is possible to get a crop of early potatoes off in sufficient time for seeding alfalfa the same season. If the potato ground has been well cultivated, it will require little further preparation for the alfalfa.

#### LIMING.

The use of lime is not essential on all soils in this region, but it is sometimes difficult to tell whether an application of lime is needed before seeding. If, however, there is any doubt concerning this point, the land should be limed. The lime may be applied with a manure spreader, a fertilizer distributor, a lime distributor, or by hand. Any method which spreads the lime uniformly and at low cost is satisfactory. It should be applied at least two or three weeks before seeding, in order that it may become thoroughly incorporated with the soil. At least a ton of burned lime is generally required, and larger applications are often necessary on the heavier soils. If ground limestone or ground oyster shell is used, the quantity should be double that of the burned lime.

Experiments have shown very little difference in the final results obtained from the different forms of lime. Burned lime will give



quicker results, but the ground limestone and ground oyster shell will finally give the same benefit. The essential element in lime in any form is the calcium oxid, and it is recommended that the farmer use whichever form of lime is cheapest, based upon the percentage of this element present. Where the consumer pays the freight, it should be remembered that he will not only have to pay such charges on practically twice as much of the ground limestone as of the burned lime, but will also be to the additional expense of hauling and spreading 2 tons of the former to 1 of the latter in order to obtain the same results.

#### FERTILIZATION.

Well-rotted barnyard manure which is comparatively free from weeds is the most satisfactory fertilizer. It should be spread on the land before plowing, in order that it may become thoroughly incorporated with the soil. Good results also follow from heavy applications to the preceding crop. Where this is not available, the judicious use of commercial fertilizers will in many cases increase the chances of success in the seeding of alfalfa. An application of 75 to 100 pounds of potash, 350 to 500 pounds of acid phosphate, and 50 to 75 pounds of nitrate of soda per acre is suggested.

#### INOCULATION.

Nitrogen-fixing bacteria should be provided unless the soil is known to be naturally supplied with these germs. This may best be accomplished by scattering over the area to be seeded soil from a field upon which the crop has previously been successfully grown. The soil should be broadcasted at the rate of from 250 to 500 pounds per acre and harrowed in immediately. The spreading should take place on a cloudy day or in the evening, as the sun's rays are destructive to the germs. Soil from the roots of sweet-clover plants also will inoculate alfalfa. Care should be taken to avoid introducing noxious weeds and fungous diseases. The practice of sowing a small amount of alfalfa with the regular seeding of clover each year for a few years before it is intended to devote the land to alfalfa has in some cases apparently introduced sufficient bacteria for inoculating the succeeding crop of alfalfa. Another method which may be used is that of inoculating the seed with an artificial culture, a limited quantity of which can be procured from the United States Department of Agriculture free of charge. Full instructions for use accompany each bottle of culture. The combined use of the soil and the artificial culture is recommended where both can be readily obtained.

#### SEEDING.

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divided and one-half sown each way of the field. Experience has shown that where the seed is drilled less is required per acre than when it is broadcasted. The use of a nurse crop, while highly desirable, is not generally recommended, except in the case of early spring seedings, when from 1 to 1½ bushels of oats or barley will assist in keeping down the weeds and may cause no serious injury to the alfalfa, provided the nurse crop is cut for hay. In some cases seeding with early canning peas has also given very good results.

The most successful stands are secured from seeding late in June or as soon thereafter as moisture conditions are favorable. It is seldom safe to seed much later than August 15, as the plants may not become thoroughly established before winter sets in. Successful stands are sometimes secured from early spring seedings, though they are not generally to be recommended.

#### TREATMENT OF STAND.

In spring seedings, unless the weeds threaten to choke out the young plants, the alfalfa should not be clipped until it is 12 to 15 inches high and beginning to bloom. The cutter bar of the mower should be set high, as the alfalfa is likely to be ruined if cut low. If the first cutting is light, it may be left on the land as a mulch, but if heavy enough to smother the alfalfa plants it should be removed. Late summer seedings should not be cut until the following season. Mowing should cease early enough to allow a growth of 8 to 10 inches to catch and hold the snow and protect the crowns. If the alfalfa goes through the winter successfully the first cutting may usually be made in June. It should be made when the plants are beginning to bloom, or, better still, when the basal shoots appear. In an average season three cuttings may be expected. If the plants turn yellow, the alfalfa should be cut, no matter what the stage of development. If the stand becomes very thin or patchy, the field should be plowed and reseeded. Attempts at patching up poor stands have not generally been successful. If the weeds threaten to destroy the alfalfa it may be necessary to resort to cultivation, but no implement which will seriously bruise the crowns and give an opportunity for disease to enter should be used. The alfalfa harrow, which is a modified form of the spring-tooth harrow, has given very good results. A top-dressing of well-rotted, weed-free stable manure applied in the late fall or early winter, preferably with a manure spreader, will not only furnish plant food, but will also serve as a protection during the winter months. Where this is not available a light application of a commercial fertilizer, consisting chiefly of acid phosphate with a small quantity of potash, will tend to increase the growth and lengthen the life of the field. Under no circumstances should the field be pastured during the first two years, and even an old field had better be pastured sparingly.



## SOME COMMERCIAL VARIETIES OF ALFALFA.

*Common alfalfa*.—Under this head is included the greater part of the alfalfa grown in the United States, the seed from the various sources frequently being designated by the State in which it was produced. Where alfalfa has been grown under a certain set of conditions for a considerable time, there is a tendency, through elimination, to produce a different type, presumably best adapted to the conditions under which it was developed. Thus, for instance, seed from fields that have been grown for several seed generations in Montana and the Dakotas may be somewhat more hardy than that grown farther south. Likewise, seed grown under semiarid conditions without irrigation may be superior for dry-land farming. In sections where winterkilling is not a factor, the ordinary types are recommended in preference to the so-called hardy alfalfas, as they generally produce somewhat heavier yields.

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H. L. WESTOVER,  
*Assistant in Agronomy.*

JANUARY 22, 1915.







